

XXXII.—*A Contribution to the Study of Nestling Birds.*
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(Text-figures 1-17.)

THERE is no branch of ornithology that has remained so long neglected as the study of nestling birds, nor is there one in which so many problems still await solution. Upon close examination, even the young of altricial birds will be found to vary considerably, and often, within the limits of a single family, they display a really remarkable adaptability to the conditions under which their parents breed. The chicks of precocial species are possibly more interesting, for they show still greater versatility, especially in regard to the pattern and texture of their downy covering, but I do not intend to deal with these now. Nor is it my intention to make an exhaustive survey of all my notes on the young of nidicolous species—these have been accumulating for twenty years or more, and have become far too bulky to be adequately condensed into a single paper. The following pages, then, must be regarded as only a small contribution to a very fascinating study, and are offered chiefly with the idea of stimulating further research.

As the terminology of plumage does not appear to be very stable and is not yet in common use, it is perhaps advisable to briefly give a few definitions of the terms I intend to adopt:—

Plumules.—The small downy feathers found in the adults of many birds. Plumules may occur either in the apteria, or in the pterygæ, or in both; but in some species they are completely absent. In the adult individual they are normally concealed by the contour-feathers.

Pre-pennæ.—The small downy feathers that precede, and are afterwards replaced by, contour-feathers. These are found in the young of many birds.

Pre-plumulæ.—The small downy feathers that precede,

and are afterwards replaced by, plumules. These are found in the young of many, though not all, the species that possess plumules in adult life. In structure pre-pennæ and pre-plumulæ are often indistinguishable.

Teleoptiles.—A comprehensive term for all contour-feathers. Newton (Dictionary of Birds, p. 243) includes adult down or plumules in his definition of this term, but its application is here restricted to contour-feathers.

Mesoptiles.—Semi-plumous feathers, forming an intermediary plumage or second generation of feathers. These are found in adolescent individuals of a few species (Barn-Owl, etc.) and are acquired between the first generation of nestling down (neossoptiles) and the adult plumage of contour-feathers (teleoptiles), and the term is here used in this restricted sense. Pycraft does not thus confine its application, but uses the word for all the forms of nestling-down immediately preceding teleoptiles. His assumption seems to be that all nestling birds originally developed two distinct generations of pre-pennæ down and that in the majority of species the first generation (which he calls "protoptiles") has now been suppressed*.

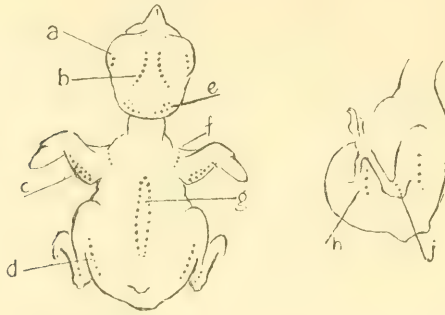
Neossoptiles or *Nestling-down* are comprehensive terms used in this paper to denote the existing first generation of down-feathers, and is applied to these whether succeeded by mesoptiles or directly followed by teleoptiles, or whether pre-pennæ or pre-plumulæ.

Fig. 1, showing the pteryllæ of the neossoptiles in a nestling Pied Wagtail (*Motacilla lugubris*), gives the nomenclature I intend to adopt for the different down tracts mentioned in this paper. It will be noticed that this nomenclature differs only slightly from that used by Ticehurst (Brit. Bds. Mag. vol. ii.), and later by Witherby in his 'Practical Handbook of British Birds.' For reasons already explained (Brit. Bds. Mag. vol. xiii. p. 78), I have substituted "capital tract" for their "inner supraorbital tract,"

* A study of the nestling plumage of some of the Raptores suggests that, in some cases at any rate, it is the second and not the first generation of nestling-down that has been suppressed (cf. fig. 17, p. 875).

and have dropped the prefix in their so-called "outer supra-orbital tract."

Text-figure 1.



Pied Wagtail (*Motacilla lugubris*), 1 day old. *a*, Supraorbital tract; *b*, Capital tract; *c*, Ulnar tract; *d*, Femoral tract; *e*, Occipital tract; *f*, Humeral tract; *g*, Spinal tract; *h*, Ventral tract; *j*, Crural tract.

Text-figure 2.



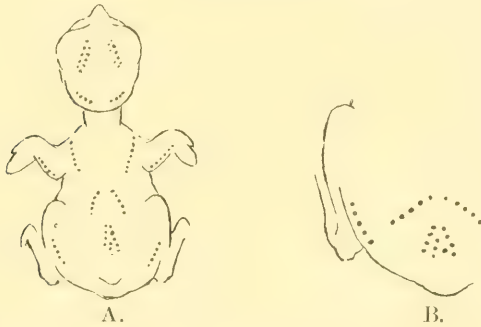
Wing of Pied Wagtail (*Motacilla lugubris*), about 8 days old, to illustrate how the ulnar tract of neossoptiles is carried on the proximal feathers of the greater and median coverts.

Neossoptiles, whether pre-pennæ or pre-plumulæ, may be carried on the extremities of the succeeding feathers either (1) as a complete tuft, *i. e.*, with the barbs united at a common base, or (2) disintegrated, *i. e.*, with individual down

barbs adhering to the tips of individual teleoptile barbs. Both cases may occur in the same bird.

In Passerine species the neossoptiles usually, though not invariably, retain the form of a tuft. These tufts precede, and are afterwards carried on, the tips of only a few, definitely distributed, contour-feathers. In the case of the Pied Wagtail figured, the down-tufts forming the ulnar tract are subsequently borne on the innermost median and greater wing-coverts. As these contour-feathers grow and increase in length, what originally appeared to be a single tract of down-tufts becomes divided into two distinctly separated lines* (see fig. 2).

Text-figure 3.



3 A. Skylark, 2 days old. 3 B. Hind part of a Skylark (*Alauda arvensis*), about 7 days old. Note how in fig. 3 B the angle formed by the double row of neossoptiles becomes more obtuse as the teleoptiles develop.

Along the humeral tract the down-tufts precede, and afterwards adhere to, the outermost and hindmost scapular feathers, but it is interesting to note that those occurring

* Incidentally it may be remarked that the feathers forming what might be aptly termed the secondary coverts (*i. e.*, the proximal section of what are collectively known as greater coverts) grow before the secondaries and at one stage of the fledgeling period exceed them in length. Ticehurst and others have been deceived by this, and have stated that the down-tufts occur on the secondaries instead of secondary coverts. In some species—Crows, for instance—vestigial down may be detected on the remiges, but this is so minute and degenerate that it has been ignored in most of the accompanying figures.

on the spinal tract are not marginally situated when the contour-feathers appear. As these latter grow the down-tufts are carried on their extremities and are forced relatively lower down the back (*cf.* figs. 3 A and 3 B).

As the time approaches for the Passerine fledgeling to leave its nest, the neossophtiles are shed by abrasion. Those subject to the greatest amount of friction—*i. e.*, on the ventral and femoral tracts—disappear first, while those on the head, owing presumably to the fact that they cannot be reached when the bird is preening its plumage, are generally retained the longest*.

It is my belief that the downy integument found in the majority of Passerine nestlings is not, as some would suggest, a functionless ancestral inheritance, but is usually of real service to the species possessing it. Its principal purpose seems to be undoubtedly that of concealment, although the retention of heat in the body is probably an important secondary use.

In some cases the oblitative effect of this downy covering is really remarkable, and it is certainly curious that this fact has not been commented on before. Take, for instance, the helpless young of Passerine species nesting in deep recesses, such as concavities in a bank, under overarching tufts of grass, or, again, in dense and low herbage. These are almost always clothed in a loose down of a dusky neutral grey or blackish colour. When in repose a nestful of such birds, huddled together, counterfeit with extraordinary fidelity a patch of deep shadow. In fact, I do not think it conceivable that there could be any more perfect device for reproducing the effect of depth without form, than this downy mass with its appearance of filmy darkness. In other words, the shadows of the natural recess in which the nest is ensconced remains virtually undisturbed, and the chance of detection is reduced to a minimum. Good examples may be found among the Pipits, Buntings,

* In a domestic fowl that had one of its legs injured as a chick, so that it was incapable of scratching its head, I noticed that the neossophtiles on the crown were retained for many months.

Accentors, Tree-creepers, Robins, and in the Nightingale and Stonechat.

On the other hand, it will be noticed that the young of altricial species nesting in more open situations, either on the level ground or among the looser vegetation of shrubs and low trees, are generally covered with down of a very much lighter shade. A moment's reflection will, I think, explain the reason for this. In such positions, it is obviously an advantage to neutralize, rather than intensify, the depth of shadow in the nest-cup.

With a few exceptions among arboreal species, the down varies in colour from smoke- or drab-grey in birds that select moderately low sites (*i. e.*, Chaffinch, Greenfinch, Linnet, Blackbird, Song-Thrush, etc.), to white or whitish in those that nest in higher and still lighter positions (Hawfinch, Goldfinch, Golden Oriole, Mistle-Thrush, etc.*). It is also significant to note that in these latter species the down is generally more profuse—compare, for instance, the Mistle-Thrush with the Song-Thrush or Blackbird, or the Hawfinch with the Linnet.

With ground-nesting birds (*i. e.*, Field-Wagtails and Larks), that build their nurseries on a level surface, and therefore more or less open to the sky, the down is generally distinctly more sandy in hue. This colour assimilates equally well with the sun-dried ground of sterile districts or the parched stems that are found near the roots of all kinds of grassy vegetation. In the case of some of the Larks, the assimilation is not due to colour alone, but is considerably assisted by a special modification of the down-feather. A good example of this can be found in the Common Skylark (*Alauda arvensis*). Upon comparing the nestling-down of this species with that of most other Passerine birds, it will be noticed that it appears very coarse in texture. This is

* An apparent exception to this rule occurs in the Crossbill. According to Ticehurst, the nestling-down of this bird is very dark grey. Although nesting high, I believe it usually builds in rather dense branches of dark-leaved conifers, in which case the downy covering may still be regarded as procrystic.

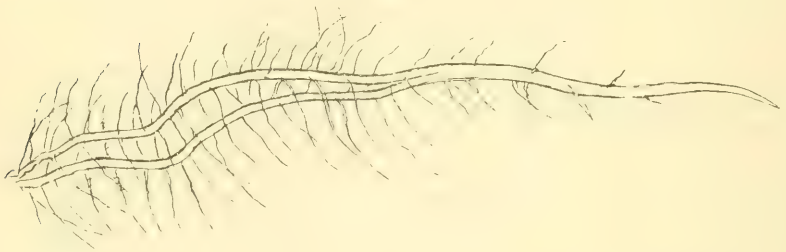
caused by the relative thickness of the pale straw-coloured barbs. In many cases the barbs composing the down-tufts are fused together in couples at about half their length, and thus form a single thickened extremity* (fig. 4). These pale extremities, backed by slightly darker bases and darker

Text-figure 4.

A.



B.



A. Single barb from the neossoptile of a Yellow Wagtail (*Motacilla raii*).

B. Fusion of two barbs in the neossoptile of a Skylark (*Alauda arvensis*).

skin, are very effective, and enable a brood of young Skylarks to become almost invisible at a distance of only a few feet. When immobile their downy covering almost exactly reproduces a plexus of withered grass-leaves.

Excluding the larger forms of altricial birds, such as the

* A similar union of the barbs produces the curious "wiry" appearance of the pre-pennæ down on the head of some of the Herons. In the Purple Heron, for instance, three or four of the down barbs become fused together for the greater part of their length, forming a single horny ribbon, evidently to assimilate the coarser type of vegetation amongst which this species breeds.

Owls or Pigeons, it is a fairly general rule to find that the species nesting in deep holes or in completely covered nests (where, of course, no special protective scheme is required) are usually quite naked when hatched, *i. e.* House-and Tree-Sparrow, Long-tailed Tit, Magpie, Kingfisher, Woodpeckers, and Swift. When this is not the case, a marked reduction in the density and distribution of the down is generally observable. There also seems to be a tendency for the down-tracts to disappear from all save the

Text-figures 5 and 6.



Fig. 5.—Tree-Creeper (*Certhia familiaris*), about 7 days old.



Fig. 6.—Tree-Creeper (*Certhia familiaris*), about 7 days old; side view of head.

more exposed anterior portions of the body in species that attempt to rear a big family in a more or less confined space. A very good example of this may be found in the two forms of Tree-Creepers (*Certhia brachydactyla* and *C. familiaris*). These birds construct a small, but deeply cupped nest, which is generally wedged into a very narrow crevice. In consequence of this, the relatively large brood (Tree-Creepers lay from six to nine eggs) always have restricted accommodation, and the young birds are almost invariably crowded together in such a way that only their heads are exposed to view. A body-covering of down would therefore be useless, but in order to conceal their heads and to obliterate the symmetrical shadows of the nest-cavity, the crown is adorned with a profusion of greyish-black down (figs. 5 & 6). A similar distribution, to which the same explanation may be applied, occurs in the Golderest (*Ticehurst*). In the

Titmice (*i. e.* Great, Marsh, and Blue Tit), although the humeral and spinal tracts are represented, these are considerably abbreviated, and the latter is usually reduced to a few tufts in the centre of the back (fig. 7*).

As I pointed out in 1907 †, it is usual with Passerine birds nesting in holes, or in dark places, to find that the flanges of the gape are much enlarged. These have a conspicuous swollen and wax-like appearance, and their purpose

Text-figures 7, 8, and 9.



Fig. 7.—Marsh - Tit
(*Parus palustris*).
about 3 days old.

Fig. 8.— Willow-
Warbler (*Phyllo-
scopus trochilus*).

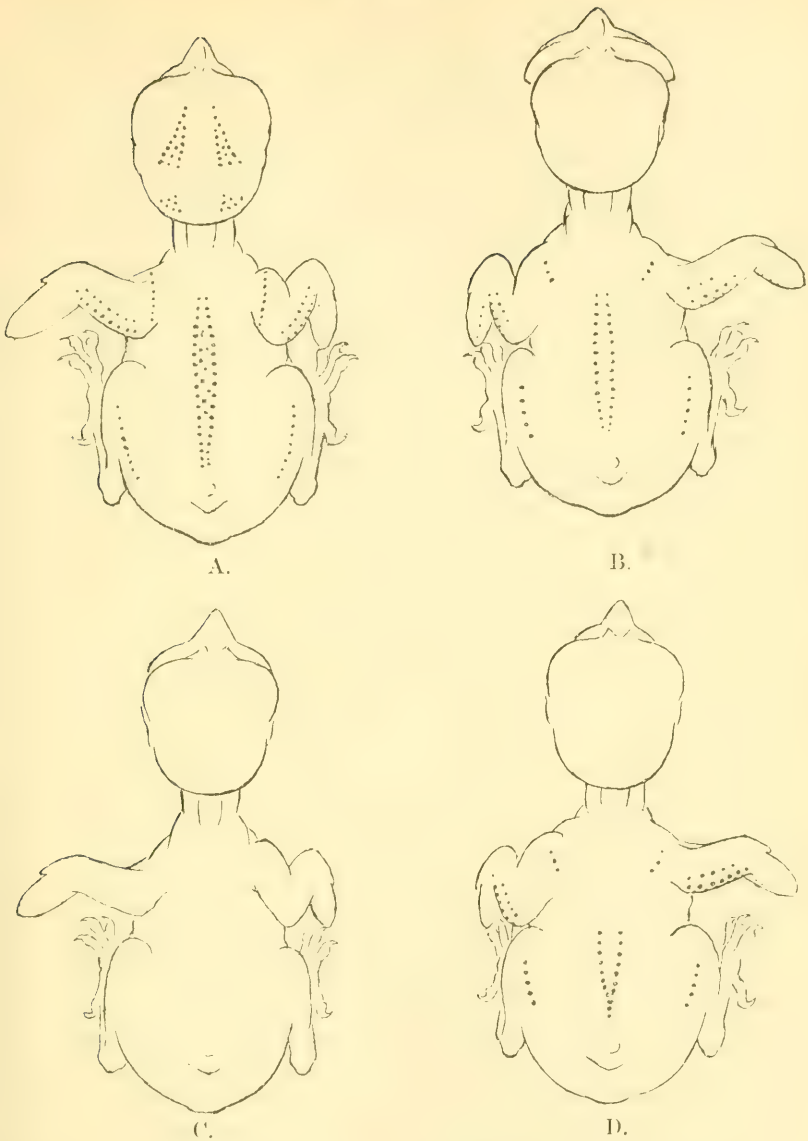
Fig. 9.—Yellow Wag-
tail (*Motacilla f. raii*),
about 2 days old.

is almost certainly to guide the feeding parent. An interesting example of the development of this feature may be found in the Jackdaw (*Corvus monedula*), which is the only member of the British Corvidæ that nests in deep holes. In most other Crows—the Rook and Carrion-Crow, for example—the gape is very much smaller and quite inconspicuous, for the flanges become darkly pigmented soon after hatching and long before the swollen process is absorbed (see fig. 10).

* Compare this with the down pterylosis of the Carrion-Crow, Wag-tails, etc., viz., species that are not usually crowded into a confined space when hatched.

† "Tongue-marks in Young Birds." *Ibis*, 1907, p. 576. This paper, by the way, was in the hands of the editor about seven months before it was published, and it was written some eight months before the appearance of Pycraft's first paper on "Young Birds," in *Brit. Bds. Mag.* (Vol. i.).

Text-figure 10.



Diagrams to illustrate variation in the same family.

- A. *Corvus corone*: down plentifully distributed, but not very long, greyish-white in colour; about 3 days old.
- B. *Corvus monedula*: down-tracts somewhat abbreviated, absent from head; greyish-white in colour; large wax-like flanges to the gape; breeds in semi-obscurity; about 4 days old.
- C. *Pica pica*: down absent; breeds in a domed nest, and is therefore protected from above; about 3 days old.
- D. *Corvus frugilegus*: down absent from head; smoky grey; gape-flanges inconspicuous; one day old.

In Picarian birds, on the other hand, I believe there is seldom, if ever, any conspicuous enlargement of the rictus, even when a species nests in dark or semi-obscure situations. An explanation of this apparent anomaly will probably be forthcoming when we more thoroughly investigate their mode of conveying food to their young. I believe the explanation lies in the fact that the majority of these birds feed their young—during the earlier stages, at any rate—by regurgitation. This is almost certainly the case with the Common Swift (*Micropus apus*), whose naked nestlings are hatched in obscure situations without a vestige of any gape-flange. Despite long vigils in dark and dusty attics, I have never succeeded in actually seeing Swifts feed their young (which, by the way, they do at very long intervals of time), but, from the actions of the parents and the groping movements of the nestlings, I have no doubt that they are nourished in their infancy entirely by regurgitation*. This being so, a visual stimulus is scarcely necessary, since the transference of food can be safely accomplished immediately contact is obtained between the mouths of the giver and receiver, and this contact is probably obtained more often by a sense of touch than by sight.

While referring to the nestling Swift it might be worth while mentioning an interesting habit I noticed last year, when handling a young bird about three or four days old. This individual, evidently feeling ill at ease in the hollow of my hand, evinced a strong and unmistakable desire to climb upwards. It was apparent that this instinct was excited by the irregular surface upon which it found itself, and I have no doubt its function is to enable the nestling to retain its position on the shallow platform that does duty for a nursery. But its method of climbing (or rather its attempt to climb, for it was not very successful) seemed to me the point of chief interest. Gripping very vigorously with its

* Nightjars have been proved to feed their young by regurgitation (Kirkman, 'Wild Life,' vol. iii.) Swifts are said to convey food to their nestlings in the form of "bundles" of insects carried under their tongue (Kirkman, 'British Bird Book,' ii. p. 360). This fact was recorded also by Gilbert White in a letter to Barrington dated Sept. 28, 1774.

claws, and waving its naked wings in an obvious endeavour to use these as subsidiary levers, it tried to hoist itself upwards by hooking its bill on to the edge of my finger. The violence of the muscular effort was evidenced by the way its whole physiognomy became contorted and its jaws stood out from the side of its face as sharp protending angles. A surprisingly good hold was obtained by the tip of the lower mandible, which appeared to be slightly decurved at its extremity. This nestling repeated these attempts to climb at intervals until it became too exhausted to make any further effort.

Although the nestling Wryneck (*Iynx torquilla*) agrees with other Picarian species in being without conspicuous rictal flanges, when hatched the tomia of the mandibles do

Text-figure 11.



Wryneck (*Iynx torquilla*), newly hatched, to show large lower mandible.

not coincide as in the Swift, Nightjar, etc. During early infancy the lower mandible is appreciably larger than the upper. This member not only protudes beyond the tip of the maxilla, but has a comparatively large swollen process running along its posterior edge (fig. 11). A possible use for this curiously formed mandible may be found when the young Wryneck's food is examined. I believe I am right in saying that the parents feed their young very largely, if not exclusively, upon quantities of ants which are carried to the nesting-hole in the throat and bill. It is obvious that a proportionately large, shovel-like mandible would greatly facilitate the safe transference of these bundles of small insects and would minimize the chance of their being spilled and wasted. The bill acquires its normal shape before the bird is fully fledged.

The remarkable heel-pads found in nestling Wrynecks

and certain other species (*i. e.*, Barbets, Toucans, and Woodpeckers) have already been commented upon by other writers, and I think Pycraft's interpretation of their use—namely, to protect the young bird from injury in its unlined nest-cavity—is undoubtedly a correct one*. It is interesting to note that incipient heel-pads may also be detected in newly-hatched specimens of the Common Starling (*Sturnus vulgaris*).

Besides those already mentioned elsewhere, neossoptiles are wanting in some, or in all, the species of the following genera:—*Hypolais*, *Acrocephalus*, *Sylvia*, *Garrulus*, *Panurus*, and *Cuculus*. As the young of most of these are reared in open nests and some of the species are small and feeble, the complete disappearance or non-development of a procryptic nestling plumage is somewhat difficult to explain.

At one time I thought the Shrikes (*Laniidæ*) were also destitute of neossoptiles when hatched, but quite recently I discovered small pre-pennæ in four- or five-day-old specimens of the Red-backed Shrike. Apart from very degenerate and insignificant down on the tips of the main wing-feathers these pre-pennæ were confined to the posterior third of the ventral tract, and were attached to seven or eight of the teleoptiles forming the median row of that tract (fig. 16). I do not know of any other birds with a similar down-pterylosis.

Fig. 10 illustrates the remarkable variation in nestlings that may occur within the limits of a single family. It will be noted, however, that most of these differences are consistent with the theories and explanations given above. The Carrion-Crow (*Corvus corone*), building in more or less elevated positions, has its nestling well furnished with greyish-white down. With the Rook (*C. frugilegus*) there is less necessity for concealment, as the bird breeds in colonies. Consequently the neossoptile plumage has degenerated somewhat and is now completely absent from the

* Beebe ('Tropical Wild Life') describes and figures the nestling Aricari Toucan (*Pteroglossus aricari*). The young of this species has very well-developed heel-pads. Upon these and the hind part of the body they apparently rest "with their feet and toes held up helplessly in mid-air."

head. The disappearance of down from this area is no doubt an advantage to a gluttonous feeder like the young Rook, and I think the same remark may also be applied to the nestling Jackdaw*. The fact that the Jackdaw's eggs are still coloured, and that the down persists in the nestling, is certainly evidence that the bird has taken to breeding in dark places at a comparatively recent date. This being so, the development of such large gape-flanges is very interesting, and illustrates, I think, the importance of these guiding processes to species nesting in dark or semi-obscure situations. The Magpie builds a nest completely screened from above; a procryptic plumage for its helpless young is therefore unnecessary, and the nestlings are consequently

Text-figure 12.



Nightjar (*Caprimulgus europæus*), 4 days old; compare with figure of the embryo (p. 870) and note appreciable reduction of the nasal excrescences.

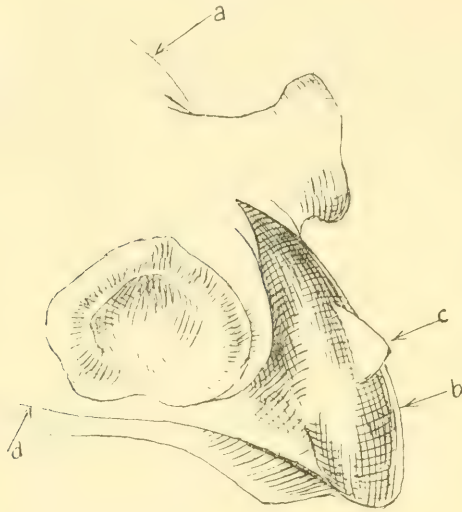
quite naked when hatched. This explanation does not apply, however, to the Jay, whose young are hatched in an open nest and who are also without any downy covering. Possibly the keen vigilance and boldness of the parents, and the fact that the nestlings are almost continuously brooded during the earlier stages, in a measure obviates the necessity for a procryptic neossoptile plumage. But with the Jay, and to a lesser degree with the Magpie, the young are no doubt partly camouflaged by the curious greenish colour of the skin, the upper parts of the nestling Jay being of a distinct olive-green hue.

In 1915 I discovered a four-day-old nestling Nightjar (*Caprimulgus europæus*) and made notes and sketches of the peculiar cup-shaped form of its nostrils (fig. 12). This

*. Cf. reduction of down on facial area in Shearwaters, Petrels, etc. (p. 874).

summer I had the opportunity of examining a fully-developed embryo of this species, and was surprised to see that this superficial enlargement of the nasal organs was even more pronounced. At this early period of its existence the Nightjar's nostrils protrude from either side of the bill like

Text-figure 13.



Nightjar (*Caprimulgus europæus*); head of the embryo much enlarged to show the remarkable superficial enlargement of the nasal organs. *a*, fleshy portion of the maxilla; *b*, horny portion of the maxilla; *c*, egg-tooth; *d*, commissure of bill.

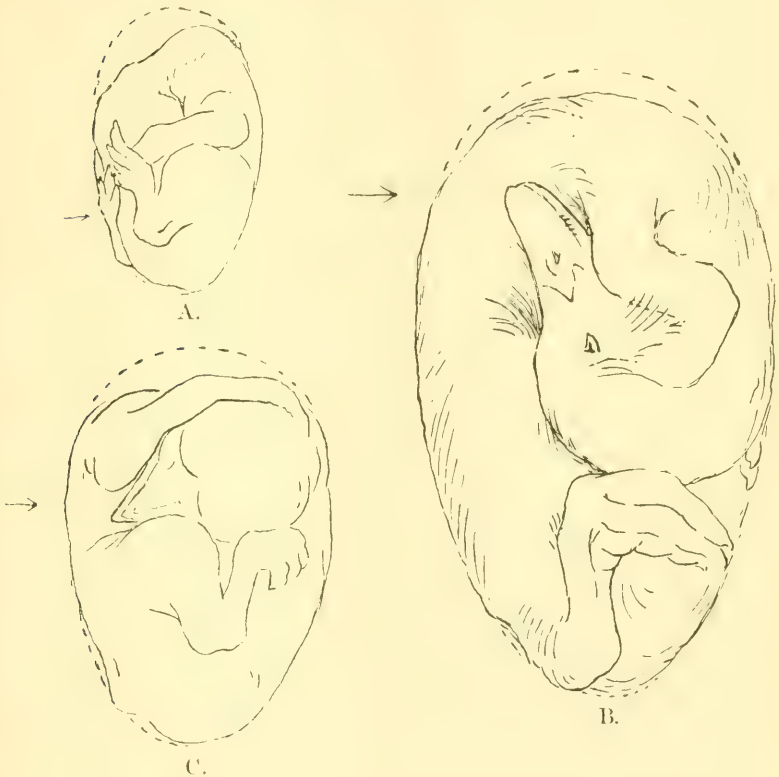
two small snouts. Under a magnifying-glass the conch-shaped apertures of these truly remarkable flesh-coloured protuberances appear to have a rounded and slightly swollen lip. A rough idea of their shape may be obtained from the accompanying figure (fig. 13) which is much magnified, and was drawn direct from the fresh specimen*.

The fact that these nasal excrescences are quickly absorbed and disappear during adolescence suggests a no

* The Dusky Nightjar (*C. nigrescens*) has "knob-like nostrils" or "rounded fleshy protuberances" in the advanced embryo stage according to Innes Hartley ('Tropical Wild Life,' p. 324).

longer useful ancestral function. What this may have been, with my present knowledge, I cannot even guess. I do not think it probable that it has any connection with the

Text-figure 14.



To show position of embryos within the egg. The arrows indicate the point at which the shell is first chipped.

A. Nightjar (*Caprimulgus europæus*).

B. Eider-Duck (*Somateria mollissima*).

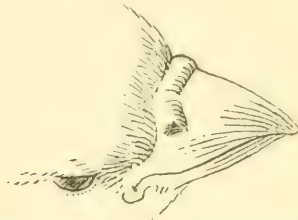
C. Rook (*Corvus frugilegus*). This position is more or less typical of most Passerine birds.

position of the embryo in the egg, although, so far as my experience goes, this is somewhat unusual. The head is tucked down in such a way that the bill and nostrils are

considerably below the longitudinal centre of the egg, and, therefore, relatively far removed from the air-space in the cap. In most birds—at any rate, in those laying eggs of a true ovate form—the position of the curled-up head causes the bill to be well above the longitudinal centre, and the chick usually chips the shell somewhere about the egg's broadest diameter (fig. 14).

The young Hawfinch (*Coccothraustes coccothraustes*) also appears to have peculiar nostrils. In a newly-fledged specimen that I examined in 1917 I noticed that there were two

Text-figure 15.



Immature Hawfinch (*Coccothraustes c. coccothraustes*), to show the peculiar nasal ridges.

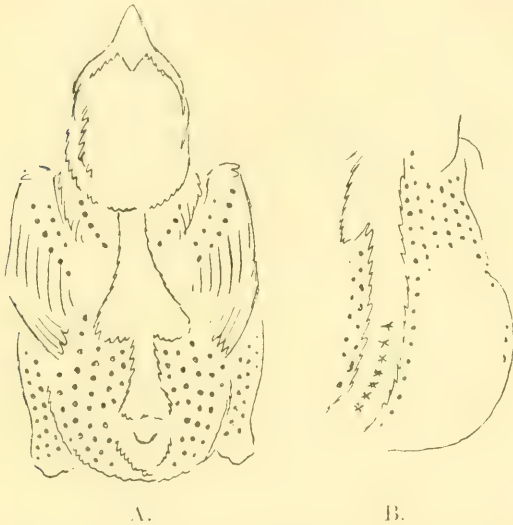
ridge-like bosses on the bill, running inwards and slightly backwards from the nasal apertures (fig. 15). In this connection it would be very instructive to examine an embryo of this Finch, but unfortunately up to the present I have not had the opportunity of doing so*.

In the young of raptorial birds the nestlings are hatched more or less evenly covered with down, composed apparently of both pre-pennæ and pre-plumulæ. This downy covering, as is well known, is usually of a uniform colour (generally white or buffish-white), but in a few members of this order a distinct pattern may be observed, and this is especially remarkable in the Osprey (*Pandion haliaëtus*). In a newly-hatched specimen of this bird, the short dense growth of down is sandy buff on the head with a light median stripe running down the nape, and a dark patch in front and

* Enlargements of the external nostrils occur also in the nestlings of some of the Parrots (*cf.* Pycraft, *Avicult. Mag.* v. 1907, p. 270).

behind the eye, while the back is dusky smoke-brown with a very conspicuous dorsal streak of pale sandy buff. The under parts are creamy white. At this stage the dark areas on the sides of the back have a somewhat mottled appearance, and this is seemingly due to the larger pre-pennæ showing through darker brown pre-plumulæ. As is usual in Raptores, when the nestling commences to grow, plumules begin to appear over most of the body. These, instead of being snowy-white as in the Eagles, Falcons, Sparrow-Hawks, etc.,

Text-figure 16.



Red-backed Shrike (*Lanius collurio*), 5 days old. A. Dorsal aspect.
B. Ventral aspect, to show distribution of plumules (•) and pre-pennæ (*).

are of a smoky-brown colour on the breast and under surface generally. The new growth of down is noticeably darker than the previous generation of pre-plumulæ carried on its tips. Conversely, in the nape and centre of the back the sprouting plumules are lighter, if anything, than the preceding pre-plumulæ, the result of this being an accentuation of the contrasting colours. The nestling Lammergeyer (*Gypætus barbatus*) is also remarkable in having a patterned garb, but

in this case the dark areas are confined to facial markings, there being a distinct greyish-brown patch on either side of the head (*cf.* the blackish facial markings in the adult). As in the Osprey, Vultures, Owls, etc., the neossoptile plumage of the newly-hatched Lammergeyer is short and dense.

In the Kites, on the other hand, the first downy covering is quite silky and filamentous in appearance, this being due to the prolongation of the golden-buff barbs and the fact that the barbules are more or less restricted to the bases of the feathers. Later on, this buff-tinted neossoptile plumage is superseded and almost entirely eclipsed by a profuse growth of white plumules, through which the dark teleoptiles ultimately sprout.

This precocious appearance of the plumules is not confined to the Falcons and Hawks. Plumules are developed contemporaneously with the teleoptiles in nestling Sand-Martins, Rooks, Shrikes (*Laniidæ*), and many other species. In these latter birds they are fairly conspicuous owing to their being white or whitish, but of course they are never so pronounced as in the Hawks, nor are they so generally distributed over the body (*fig. 16*).

The most profuse neossoptile plumage is probably found in the Shearwaters, Petrels, and allied families. In these birds the nestlings are completely covered (with the exception of the face and throat) with a dense mass of long, loose, and very soft down. This covering appears to be composed chiefly of pre-pennæ, but I have detected smaller pre-plumulæ in half-grown specimens of some of the Shearwaters. On the forehead, sides of the face, and throat the down is either reduced to a few filamentous feathers or else is very short and velvety in texture. A similar reduction of down on the facial areas may be noticed, I believe, in all birds that feed their young by regurgitation, i. e., *Phalacrocorax*, *Sula*, *Phaenicopterus*, *Columba*, *Turtur*, etc.—the reason for this being obvious.

In contradistinction to the Passeres, with the nestling Petrels and Shearwaters the down is retained longest on the under surface, and it is a common thing to find specimens

with a thick wad of down remaining on the breast when it has entirely disappeared from all the other portions of the body. This is doubtless explained by the fact that the contour-feathers are rather more precocious on the upper

Text-figure 17.



Pre-pennæ from a young Goshawk (*Astur palumbarius*),
three-parts grown.

- A. Secondary feather, with pre-pennæ adhering to filamentous prolongations of the barb. This probably illustrates the three generations of plumage—protopile, mesoptile, and teleoptile.
- B. Feather from the crown of the same bird, with pre-pennæ sessile on the extremity.

parts; the downy tips to the barbs are therefore sooner subjected to abrasion and are consequently moulted first.

If we examine partially-fledged specimens of some of the Raptores, we will find that in many cases the distal barbs of

Table showing Distribution of Neossoptiles in some British altricial Birds.

Species.	Head.			Humeral.	Ulnar.	Spinal.	Femoral.	Crural.	Ventral.	Colour.	Quantity and quality.	Source of information.
	Supra-orbital.	Capital.	Occipital.									
<i>Corvus corax</i>	+	+	+	+	+	...	+	Mouse-brown.	Plentiful.	Witherby (from skin) and Dunlop.
<i>C. cornix</i>	+	+	+	+	+	+	Drab-grey.	Fairly plentiful.	Ingram (from skin).
<i>C. corone</i>	+	+	+	+	+	+	Greyish-white.	Fairly dense, but not very long.	Ingram.
<i>C. frugilegus</i>	+	+	+	+	Smoky-grey.	Not very profuse.	Ingram.
<i>C. monedula</i>	+	+	+	+	Pale greyish.	Not profuse.	Ingram.
<i>Nucifraga caryocatactes</i>	+	+	+	?	?	?	Buffish-white.	?	Ingram (from skin).
<i>Sturnus vulgaris</i>	+	+	+	+	+	+	+	+	Smoke-grey, becoming greyish-white on lower portion of spinal tract.	Plentiful; fairly long.	Ingram.
<i>Oriolus oriolus</i>	+	+	+	+	+	+	+	...	+	Sandy- or buffish-white.	Plentiful, but not very long.	Ingram.
<i>Coccothraustes coccothraustes</i>	+	+	+	+	+	+	+	+	Snow-white.	Plentiful; long.	Ticehurst.
<i>Chloris chloris</i>	+	+	+	+	+	+	+	+	Greyish-white.	Moderately thick and fairly long.	Ingram.
<i>Carduelis carduelis</i>	+	+	+	+	+	+	+	+	+	White.	Moderately thick and rather long.	Ingram.
<i>C. linaria cabaret</i>	+	+	+	+	+	+	+	+	Pale smoky-grey, white at base.	Moderately thick.	Ingram.
<i>C. cannabina</i>	+	+	+	+	+	+	+	+	Smoke-grey.	Moderately thick.	Ingram.
<i>Pyrrhula p. pileata</i>	+	+	+	+	+	+	+	+	Blackish-grey.	Abundant and long.	Ticehurst.
<i>Loxia c. curvirostra</i>	+	+	+	+	+	+	+	+	+	Very-ark grey.	Plentiful; fairly long.	Ticehurst.

Ingram.	Tolerably thick.	Pale greyish-buff.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Fringilla caerulea</i>
Tychemurst.	Fairly plentiful.	White.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>F. montifringilla</i>
Ingram.	Fairly plentiful.	Drab-buff.	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Emberiza caelans</i>
Ingram (Tychemurst includes cranial and ventral tracts; In my specimens these were possibly worn off in both species).	Plentiful.	Smoky-grey.	?	?	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>E. hortulana</i>
	Fairly plentiful.	(greyish-black.	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>E. schottiana</i>
Tychemurst.	Fairly long.	Dark grey.	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Protophormia virens</i>
Ingram.	Abundant and fairly long.	Uniform pale yellow- ish-buff.	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Halictus erythronotus</i>
Ingram.	Abundant and fairly long.	Straw-colour, slightly darker, ventral buff at base.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Alauda arvensis</i>
(from skn). Witherby.	Fairly long and plentiful.	Pale straw-colour.	...	+	+	?	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Eremophila alpestris</i>
Ingram.	Fairly long and plentiful.	Dark smoke-grey.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Anthus trichotis</i>
Ingram.	Moderately long and plentiful.	Dingy grey.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>A. pratensis</i>
Tychemurst (spirit- specimen).	Fairly long and moderately plentiful.	Greyish-black.	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>A. cervinus</i>
Ingram.	Fairly long and moderately plentiful.	Smoke-grey.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>A. spodiola pedunculatus</i>
Ingram.	Moderately long and plentiful.	Creamy-buff or bis- cuit-colour.	...	...	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>Molothrus pectoratus</i>
Ingram.	Moderately long and plentiful.	Pale sandy-buff.	...	?	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>M. f. virens</i>
Witherby.	Fairly long.	Golden-buff.	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>M. cinerea</i>
Ingram.	Moderately long and fairly plentiful.	Smoky drab-grey.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<i>M. alba lugubris</i>
Ingram.	Profuse and long.	(greyish-black.	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	<i>(Cybina) parvirostris hollanderi</i>
Ingram.	Profuse and long.	Dark smoky-grey.	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	<i>(C. brochophala)</i>

Species.	Head.			Humeral.	Ulnar.	Spinal.	Femoral.	Cruval.	Ventral.	Colour.	Quantity and quality.	Source of information.
	Supra-orbital.	Capital.	Occipital.									
<i>Tichodroma muraria</i>	+	?	?	?	+	Greyish-drab.	Fairly long.	Ingram (dry skin).
<i>Sitta europæa</i>	+	?	?	?	?	?	?	?	?	Pale greyish-drab.	Scanty?	Ingram (dry skin).
<i>Parus major</i>	+	+	+	..	+	Whitish-grey.	Somewhat scanty; tracts much abbreviated.	Ingram.
<i>P. cæruleus</i>	+	+	+	Whitish.	Not very profuse.	Ingram.
<i>P. ater</i> *	+	+	+	..	+	Pale smoky-grey.	Not very profuse.	Ingram.
<i>P. palustris</i>	+	+	+	..	+	Greyish-white.	Somewhat scanty.	Ingram.
<i>Regulus r. anglorum</i>	+	+	Dark grey.	Short and scanty.	Ticehurst.
<i>Lanius collurio</i> †	+	Ingram.
<i>Muscicapa hypoleuca</i>	+	+	+	..	+	Dark grey.	Scanty; moderate length.	Ticehurst.
<i>M. striata (grisola)</i>	+	+	+	..	+	+	Smoky-grey.	Moderate length.	Ingram.
<i>Phylloscopus trochilus</i>	+	+	+	Pale greyish.	Not very plentiful.	Ingram.
<i>Ph. sibilatrix</i>	+	+	+	Greyish-white.	Fairly long and scanty.	Ingram.
<i>Turdus viscivorus</i> ‡	+	+	+	+	+	Buffish-white.	Profuse.	Ingram.
<i>T. philomelos (musicus)</i>	+	+	+	+	Pale sandy-buff.	Fairly long, but not very dense.	Ingram.
<i>T. merula</i> §	+	+	+	+	Smoky-drab.	Not very dense.	Ingram.
<i>T. torquatus</i>	+	+	+	+	Pale buffish-grey.	Moderately long.	Ticehurst.
<i>T. musicus (iliacus)</i>	+	+	+	+	Pale buffish-white.	Moderate length.	Ingram.
<i>Enanthe ananthe</i>	+	+	+	Dark grey.	Moderate length.	Ticehurst.
<i>Saricola rubetra</i>	+	+	..	+	Grey.	.....	Leigh.
<i>S. torquata</i>	+	+	..	+	Dark grey.	Moderate length.	Ticehurst.
<i>Phœnicurus ochrurus gibraltariensis</i> 	+	+	?	..	+	Brownish-grey.	Fairly long.	Ingram (dry skin).
<i>Phœnicurus phœnicurus</i>	+	+	+	..	+	Dark grey.	Long.	Ticehurst.

the more important feathers have filamentous prolongations, and these often form a sort of fringe to the rounded end of the feathers. In the Goshawk these barb-extensions are delicate and tapering, but they are sometimes quite blunt as in *Aquila navia*. Where these filamentous prolongations occur (*i. e.* on the secondaries in young Goshawks) the pre-pennæ down-tufts are carried on the extremities of the central ones, opposite the end of the shaft. From this fact it seems probable that these barb-prolongations form the degenerate remains of a once distinct mesoptile plumage, a generation of plumage which may be still found in a fairly complete form in the Tawny Owl. It should be noted that where the barb-prolongations are wanting, as always appears to be the case with the lesser contour-feathers on the crown, back, etc., the pre-pennæ down-tufts are sessile (fig. 17, p. 875).

A close examination of the neossoptiles in different genera reveals considerable structural variation in these feathers. In the present paper I have only hinted at a few of these differences, but I hope at some future date to make use of the data and material in my possession, and also to elaborate my notes on certain nidifugous species.

[NOTE.—The figures are all larger than natural size. Unfortunately, owing to the fact that they were drawn direct from life at different times, the scale to which they have been enlarged varies in almost every case.]

XXXIII.—*Notes on the Birds of North-East Chihli, in North China.* Part II.* By J. D. D. LA TOUCHE, C.M.Z.S., M.B.O.U.

73. *Merula hortulorum* (P. Sel.).

Turdus hortulorum and *Turdus pelios* D. & O. p. 151.

Merula hortulorum La T. p. 571.

The Grey-backed Ouzel is of irregular occurrence at Chin-wangtao. In 1911, I saw three on the 29th of April and 1st of May, but did not meet with any others until 1914,

* For Part I, *vide supra*, pp. 629-671.